Highlights from Building Technologies Office, Residential Buildings Program

Joan Glickman
Acting Program Manager
Residential Buildings Integration
February 5, 2020
Today’s Talk: Strategic Initiatives for Driving Retrofits

- Advanced Building Construction
- Workforce
- Technology Challenges
- Home Energy Score
- Lifecycle Energy and Carbon Accounting
Half of Our Nation’s Buildings > 40 Years Old

- Updating our existing buildings generally beats building new efficient ones (from lifecycle energy perspective)
- Depending on assumptions…takes between 10 to 80 years to make up the energy used during construction

### Commercial Buildings

- **percent of buildings**
- **percent of floorspace**

### Residential Buildings

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Estimate (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Family</td>
<td>80</td>
</tr>
<tr>
<td>2 to 4</td>
<td>10</td>
</tr>
<tr>
<td>5 or more</td>
<td>20</td>
</tr>
<tr>
<td>Mobile/Trailer</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total Occupied Units</strong></td>
<td><strong>118</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year Structure Built</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 to 2015</td>
<td>4</td>
</tr>
<tr>
<td>2005 to 2009</td>
<td>8</td>
</tr>
<tr>
<td>2000 to 2004</td>
<td>9</td>
</tr>
<tr>
<td>1990s</td>
<td>15</td>
</tr>
<tr>
<td>1980s</td>
<td>16</td>
</tr>
<tr>
<td>1970s</td>
<td>18</td>
</tr>
<tr>
<td>1960s</td>
<td>13</td>
</tr>
<tr>
<td>1950s</td>
<td>13</td>
</tr>
<tr>
<td>1940s</td>
<td>6</td>
</tr>
<tr>
<td>1930s</td>
<td>4</td>
</tr>
<tr>
<td>1920s</td>
<td>5</td>
</tr>
<tr>
<td>pre-1920</td>
<td>8</td>
</tr>
</tbody>
</table>

**Median Year Built**: 1976
Current Approach Won’t Cut It

Energy retrofits today are...

✓ Too slow
✓ Too disruptive
✓ Too costly
✓ Too short on energy savings
✓ Not commoditized…

“I can’t buy it on Amazon”

For these reasons, **retrofits are** few and far between, unappealing to majority of home owners and building owners
U.S. construction sector productivity lagging considerably

Typical construction today is characterized by…

✓ Poor productivity compared to other industries
✓ Cost and schedule overruns

In the U.S., labor productivity has declined since 1968

ABC: Infuse EE into efforts to modernize construction industry

Vision: A transformed U.S. construction industry that produces highly efficient new buildings and retrofits at scale.

Advanced Building Construction (ABC) means buildings –

• Designed for high performance in a changing climate
  – Highly efficient*
  – Low or negative embodied carbon
  – Grid-interactive with valuable grid services
  – Resilient to local disaster risks and other threats

• Built or renovated with minimum onsite construction time

• Affordable and appealing to building owners, tenants, and investors

*Highly efficient buildings are defined as -
1) new buildings that are 50% more efficient when compared to current code (i.e., 2018 International Energy Conservation Code and ANSI/ASHRAE/IES Standard 90.1-2016) than 2018 IECC code for new buildings; and

1) existing buildings with an energy use intensity (EUI) for space heating, space cooling, water heating, and ventilation less than or equal to 75% below the median EUI for those loads in the specific building type and location.
One Inspiration for ABC: Energiesprong in the NL

BEAUTIFUL, WARM AND AFFORDABLE

HOMES FOR LIFE.
ABC Key Areas of Focus

By focusing on the following key areas, ABC technologies and approaches can be validated, prepared to scale rapidly, and tied to a growing market for such products and solutions.

1) Research, Development & Validation
2) Analysis & Tools
3) Market Development
4) Technology Commercialization
5) ABC Collaborative/Stakeholder Engagement
ABC Collaborative

Bringing together diverse stakeholders to inform, advance and help scale ABC

Create technology cohorts
- Facilitate collaboration where linkages between different partial solutions (e.g., envelope, HVAC, software) show promise

Work with federal, state, and local entities interested in --
- Funding complementary research, development and validation of ABC technologies
- Applying ABC solutions

Facilitate “match-ups” between manufacturers and building owners
- Gain commitments from manufacturers to provide ABC technologies; and from building owners to implement ABC projects

Address barriers to scaling ABC technologies and approaches
- Develop expedited 3rd party testing process
- Pursue innovative business models including financing and insurance
Technology Challenges

Challenging industry to fill a market need with an energy saving, new-to-market technology

How Challenges Work…

- Select targeted technology (consider energy savings potential, market appeal)
- Develop specifications
- Garner “soft” procurement commitments
- Issue “challenge” to manufacturers (specs, timeline, testing)
- Involve stakeholders throughout process
- Manufacturers develop products to meet specs
- Equipment purchased & installed

Benefits of this Approach…

- Spurs innovation
- Encourages earlier understanding of consumer interests and industry capabilities
- Links supply and demand by matching prospective end users to manufacturers engaged in challenge
- Strives to disrupt traditional thinking
Technology Challenges – Proven Successes to Date

Prior Challenges/Successes

• Developed meter under $100 wireless meter
• Exceeded required communication success rate of 95%

RTU Challenge (2010-2012)
• Develop an 18 IEER RTU plus advanced features
• Outcome: Daikin McQuay’s Rebel rooftop units reduce energy use by as much as 50%
• At least 7 brands exceed 18 IEER today

Current & Future Challenges

Residential Buildings
• Automated Fault Detection & Diagnostics in HVAC equipment; other technologies TBD
• Significant benefits for public housing and other large residential building holders

Commercial Buildings
• IoT Troffer Challenge (2018-2020); additional challenges TBD
  o Goal to develop a competitively priced, USB like port for an IoT-enabled troffer for lighting sensor products
  o Desired outcome: Manufacturer meets the price % increase (e.g. 10%) and demonstrate IoT connectivity that is upgradeable and adaptable.
Workforce Development

Challenges in Efficiency Workforce

- Poor Quality Installation
- Low Interest & Awareness
  - Result: Efficiency installations that are slow, expensive, and low performing
- Low Productivity
- Lack of Efficiency Continuing Education
- Lack of Diversity
- Confusing Pathways

BTO Areas of Focus

- Support development of workforce training, curricula, and competencies for key jobs
- Engage key stakeholders including sectors that have not traditionally been a focus for BTO (e.g., community and technical colleges, & construction trade educators)
- Launch workforce roundtable to facilitate partner/stakeholder input & engagement
- Coordinate with broader EERE “clean energy workforce” strategy under development
Home Energy Score

Progress Updates

- 130,000+ Home Energy Scores
- State Energy Office programs
  - OR, MO, CT, AK & MA (coming soon!)
- City implementations
  - Portland, OR; Berkeley, CA; Carlsbad, CA; Milwaukie, OR; Denver, CO; and more
- EnergyPlus Modeling Platform
  - More consistency across new & existing homes
- Remote QA & mentoring for nationwide access
- Fannie Mae & Freddie Mac efficiency financing

Online Resources

- Bringing Home Energy Information to Real Estate: A Toolkit
- Residential Energy Efficiency for Local Governments
- Coming Soon! “Home Energy Labeling: Steps states can take to support city-based home energy labeling”

State Spotlight: Oregon

- ODOE set up framework for cities to easily implement Score
- Portland, OR requires Score in real estate listings (17,000+ Scores to date)
- Milwaukie, OR is latest OR city to adopt Score ordinance, more expected

“Updated, energy efficient Kenton bungalow... Home Energy Score = 10”
https://rpt.greenbuildingregistry.com/hes/OR10097929
A Sobering Statistic: Global building stock expected to more than double in area by 2060.

Over the next 35 years, 

**two trillion ft\(^2\)**

of new and rebuilt buildings will be constructed in cities worldwide.

An entire New York City every 35 days for 35 years!

Need a Systematic Approach to Lifecycle Energy & Carbon Analysis

Small study highlights the importance of considering both operational and embodied energy as we meet future building challenges.

Joan Glickman
Program Manager (Acting)
Residential Buildings Integration
DOE Building Technologies Office
joan.glickman@ee.doe.gov
202.586.5607 (office) / 202.492.5080 (cell)